

January 25, 2024 | 2:00-3:00 pm ET

# DEPLOYING TECHNOLOGY TO EXPLORE PARK USAGE AND IMPACT

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Landscape Architecture  
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# The Underline



Public-Private multi-modal transportation corridor, linear park and community destination improving first and last mile and neighborhood connections, safety, mobility, public health, resiliency, and innovation.

A black and white photograph of a tropical coastal town. The foreground shows a body of water with several boats, including a large wooden boat with a mast. The middle ground features a dense forest of palm trees and other tropical vegetation. A prominent white building with a steeple is visible on the left side. The background shows a distant shoreline with more trees and a small boat on the water. The word "Jungle" is overlaid in large white text in the center of the image.

# Jungle

An aerial photograph of a city skyline at dusk. The sky is filled with dramatic, dark clouds, and the city lights are beginning to glow. The word "Concrete" is written in a large, white, sans-serif font across the center of the image. The city features numerous high-rise buildings, some with illuminated windows, and a waterfront area with a curved promenade and a body of water in the foreground. The overall scene conveys a sense of urban density and modern architecture.

# Concrete

# Miami Herald

Part of the McClatchy Media Network

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# Consequences

Miami really is hotter this summer than last summer. And any other year on record

BY ALEX HARRIS

UPDATED JULY 19, 2023 12:09 PM



## *A 20-Foot Sea Wall? Miami Faces the Hard Choices of Climate Change.*

A proposal to construct barriers for storm surge protection has forced South Floridians to reckon with the many environmental challenges they face.

 Share full article



 :K



**Florida is the deadliest state for  
cyclists and the second  
deadliest state for pedestrians**

**Miami-Dade among the most  
dangerous places to walk, bike  
and run in the country**

# Reclaim



# Rewild



A photograph of two monarch butterflies on yellow flowers. The butterflies have orange wings with black veins and a black border with white spots. They are perched on clusters of small yellow flowers. The background is a soft-focus green, suggesting foliage. The word "Restore" is overlaid in white text in the center of the image.

# Restore

# Mission

To deliver and activate a 120-acre, first-class linear park spanning 10-miles below Miami's Metrorail that will transform regional mobility and celebrate diversity, culture and lifelong learning. Through innovative urban trails and creative programming, we are connecting people to their environment and each other to create a safe, healthy, equitable, and sustainable community.



# Solve Problems

## Safety/Mobility

Multi-modal solution connecting to mass transit

## Health/Wellness

Improve safe access to active transportation and recreation

## Resiliency

120 acres of green space, microforests, pollinators and stormwater mitigation

## Connectivity

10 miles Downtown to Dadeland, 250,000 residents, 14,000 businesses

## Diversity/Inclusivity

Serving persons of all abilities and access

## Innovation

Technology integration. 18 student and small business startups. Project will generate over \$3 Billion in economic activity

# Costs



- Miami Dade County \$80 M
- Federal \$25 M
- State of Florida \$22 M
- Miami \$16 M
- Coral Gables \$7 M
- Other \$4 M

# Impact

- **Visitors:** 1.7 million total visitors now. 9 million projected.
- **Events:** 225 events and programs now. 1,000 projected annually.
- **Participants:** 12,000 now. 100,000 projected annually.
- **Businesses:** 18 launched. 100 projected.
- **Art:** 6 now. 20 projected.
- **Partners:** 150 now. 500 projected.



**\$9 Billion**



# Before



# Brickell Backyard



# Public Art





# Free Programs

A group of children are playing basketball on an outdoor court with a green and black surface. The court is surrounded by a green safety fence. In the background, there are tall buildings and a sign for 'SOLITAIR BRICKELL NOW LEASING LUXURY APARTMENTS'. The scene is set in an urban environment with modern architecture.





Swaggrags

STATUS+  
OVER ON MY WORST DAY STATUS IS PLUS





## **3 key priorities for The Underline:**

- **safe multi-modal transportation**
- **nature**
- **community**





planted buffer along US-1

dedicated pedestrian path

dedicated bike path

2'

10'

2'

**Bike Path:** one dedicated, two way, 10-foot wide bike path with a min. 5-foot planted area along US-1



GROWS MUCH FASTER  
THAN TRADITIONAL  
AFFORESTATION  
STRATEGIES



THE DENSITY ALLOWS  
FOR SPECIES TO THRIVE  
WITH VERY LOW  
MAINTENANCE



PROVIDES VERY HIGH  
BIODIVERSITY IN A VERY  
LIMITED FOOTPRINT



THE ALL NATIVE PLANTINGS  
PROVIDE REFUGE FOR  
POLLINATORS AND OTHER  
ANIMALS AND FUNGI



PROVIDES ESSENTIAL  
ECOLOGICAL SERVICES TO THE  
SUUROUNING COMMUNITY AND  
OPPORTUNITIES FOR LEARNING

# Nature



HARDWOOD HAMMOCK "ISLAND"



MICRO-FOREST EXAMPLES



COMMUNITY INVOLVEMENT OPPORTUNITIES



**Micro-forest** : the first in South Florida! (miyawaki afforestation method)



sabal palm

simpson stopper

slash pine

coontie

saw palmetto

# Green

**Phase 3 will include 1,800 new trees and palms and over 350,000 new plants!**

# Blue



waterside seating

restored riparian edges

water access

\* kayak launch by Miami-Dade PRD to be provided at a later date, pending funding

**E | Water Balcony** : a new bridge and nature observation balcony over the Gables Waterway

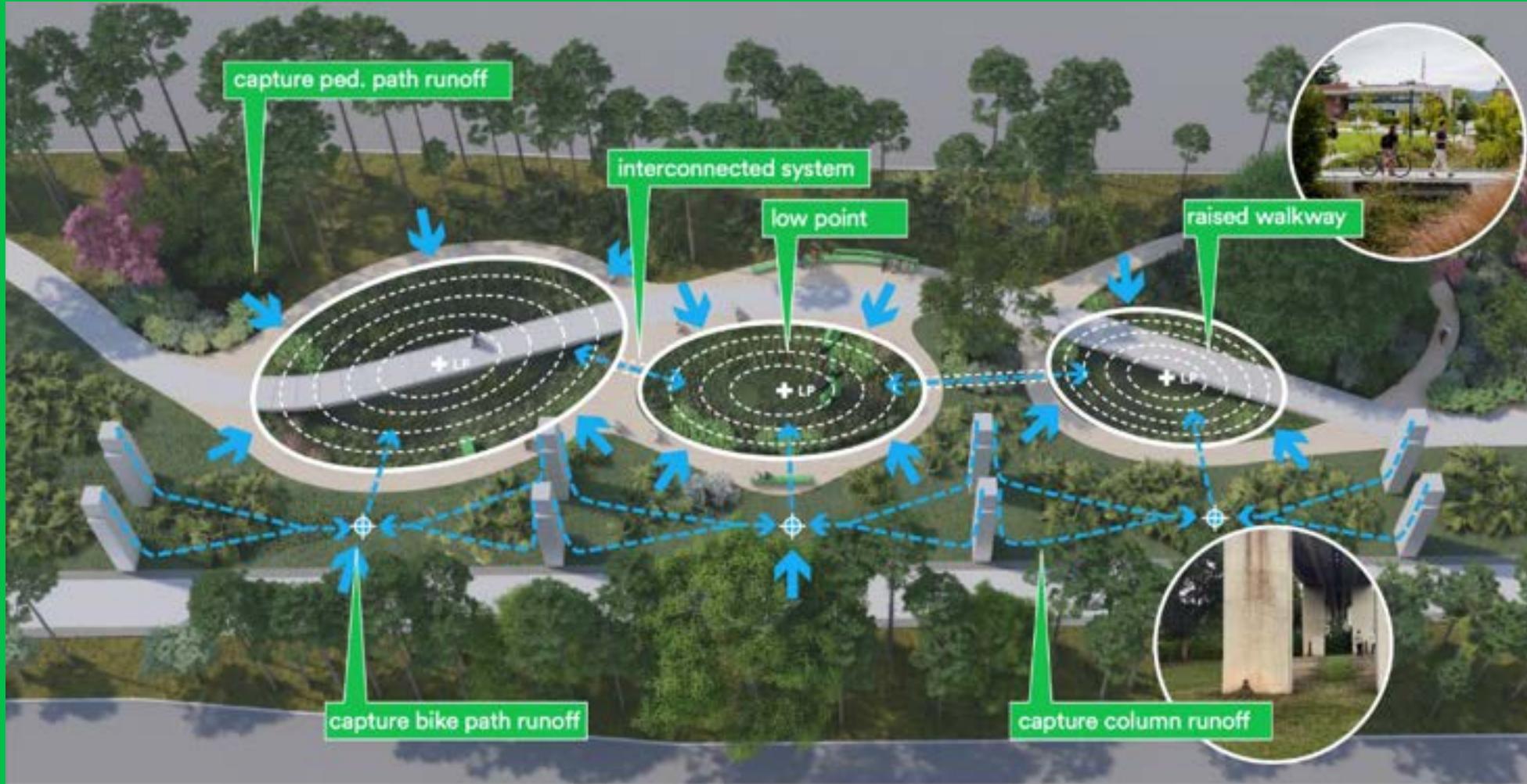


# Blue & Green

**F | Rain Gardens : improving water quality while creating new habitats**



# Phase 3 Innovative Green Infrastructure



**Bioretention basins**



pine rockland planting

micro-forest

public art

bike path

The Underline

bioretention ponds

**G | Stormwater Ponds : improving site resilience**

# Community

events plaza

boulder seating

**I | Rock Ridge Plaza : an outdoor classroom and performance space**

# Play

pickleball courts

micro-forest

THE U TOURNAMENT

\* pending funding

**H | Pineland Courts** : pickleball, mini-soccer pitch and basketball courts nestled in a new landscape



shade trees

# Dogs

doggie tunnel

seating areas

artificial turf

\* designed by Savino Miller landscape architects  
for the City of Coral Gables

**C | Bark Park** : an exciting agility course for our four-legged friends!

# Children

shade trees

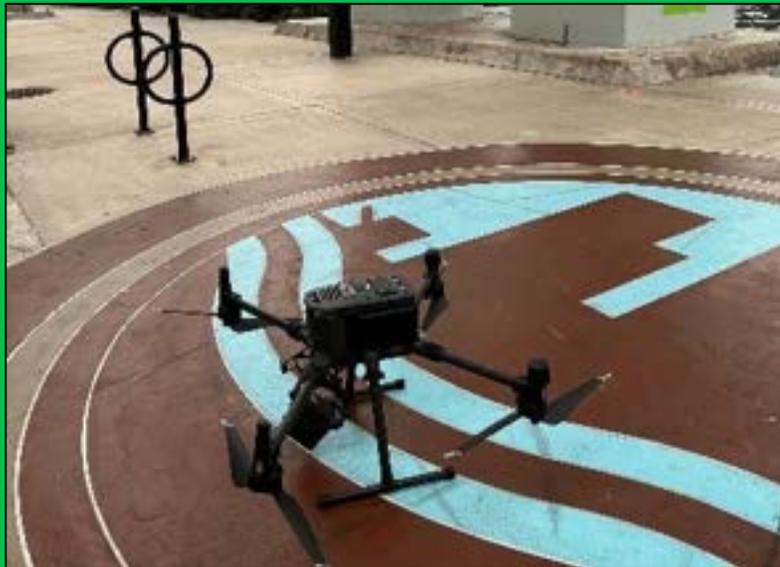
log tunnel

musical instruments

exploration trail

**K | Play Forest** : a natural playscape and exploration area set within lush tropical gardens

# Community & Innovation



**Foundational**  
**Operational**  
**Experiential**

# Ubiquitous WiFi

**10 miles of Fiber. 75K users.**

- Agreement with Hotwire Communications to provide free WiFi as an in-kind service to visitors.
- Will enable the community access to information and support the programming and event efforts of Friends of The Underline.
- Helps the 20% of Miami-Dade County households without an internet subscription.
- WiFi will also serve as foundational technology to support the installation of future devices, sensors, cameras, and more.



# Digital Twin

## 3D virtual mirror of real-world park

To simulate, test, monitor and maintain physical assets and data in a digital environment

- **Asset mgmt.** Optimize resources
- **Planning & Design.** Test scenarios
- **Monitoring.** Behaviors, maintenance
- **Environment.** Measure park impact
- **Safety/security.** Simulate emergency
- **Engagement/Education.** Interactive experiences, wayfinding, etc.





# Why Digital Twin Technology

## Asset Management

Manage, track, and optimize all park assets in The Underline.

## Environment

Track and visualize all environmental data collected in the park.

## Planning & Design

Design spaces, test scenarios, and evaluate impact of design choices before they are built.

## Safety/Security

Simulate emergency scenarios, test safety protocols, and real-time monitoring of park activity.

## Monitoring/Maintenance

Monitor performance, visitor behavior, amenity usage, maintenance issues, and optimize resource use.

## Engagement/Education

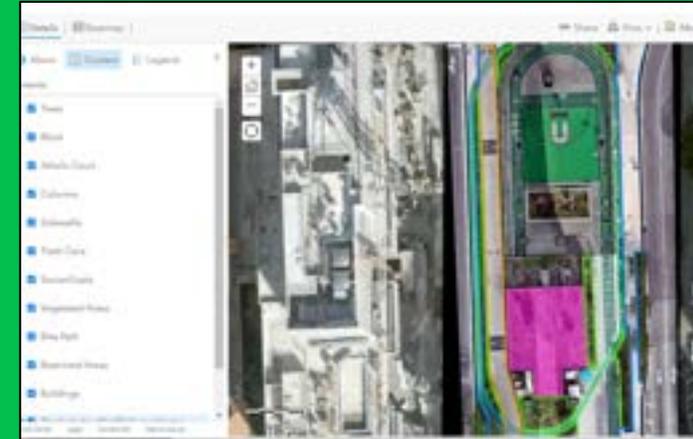
Create interactive experiences for visitors and allow them to explore the space and learn about it virtually.

# Digital Twin Components

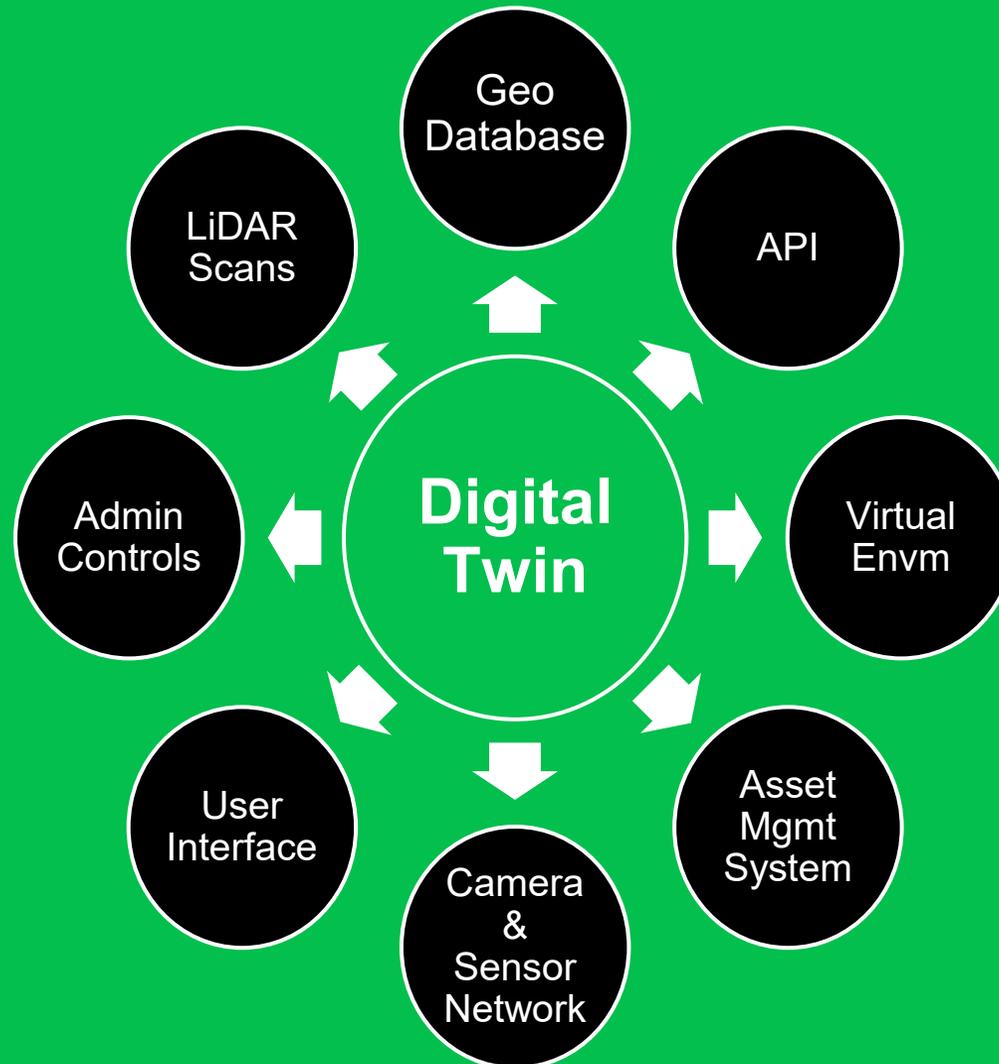
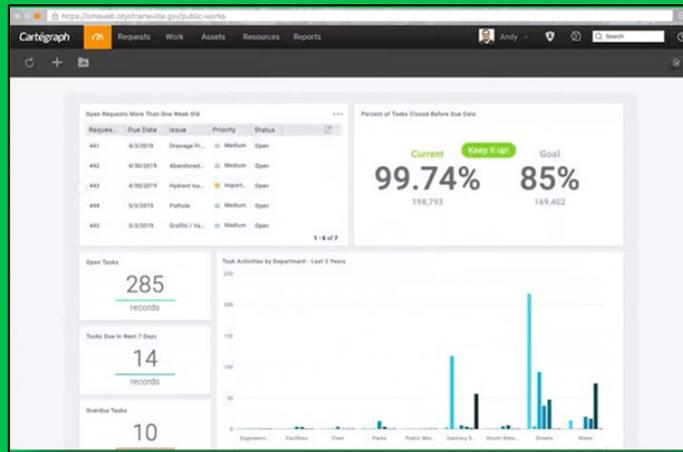
Lidar Scans



Geo Database



Asset Mgmt



Virtual Environment





# Data Sources

## Ubiquitous WiFi



## LiDAR Scans



## Cameras/Computer Vision



## Sensor Network



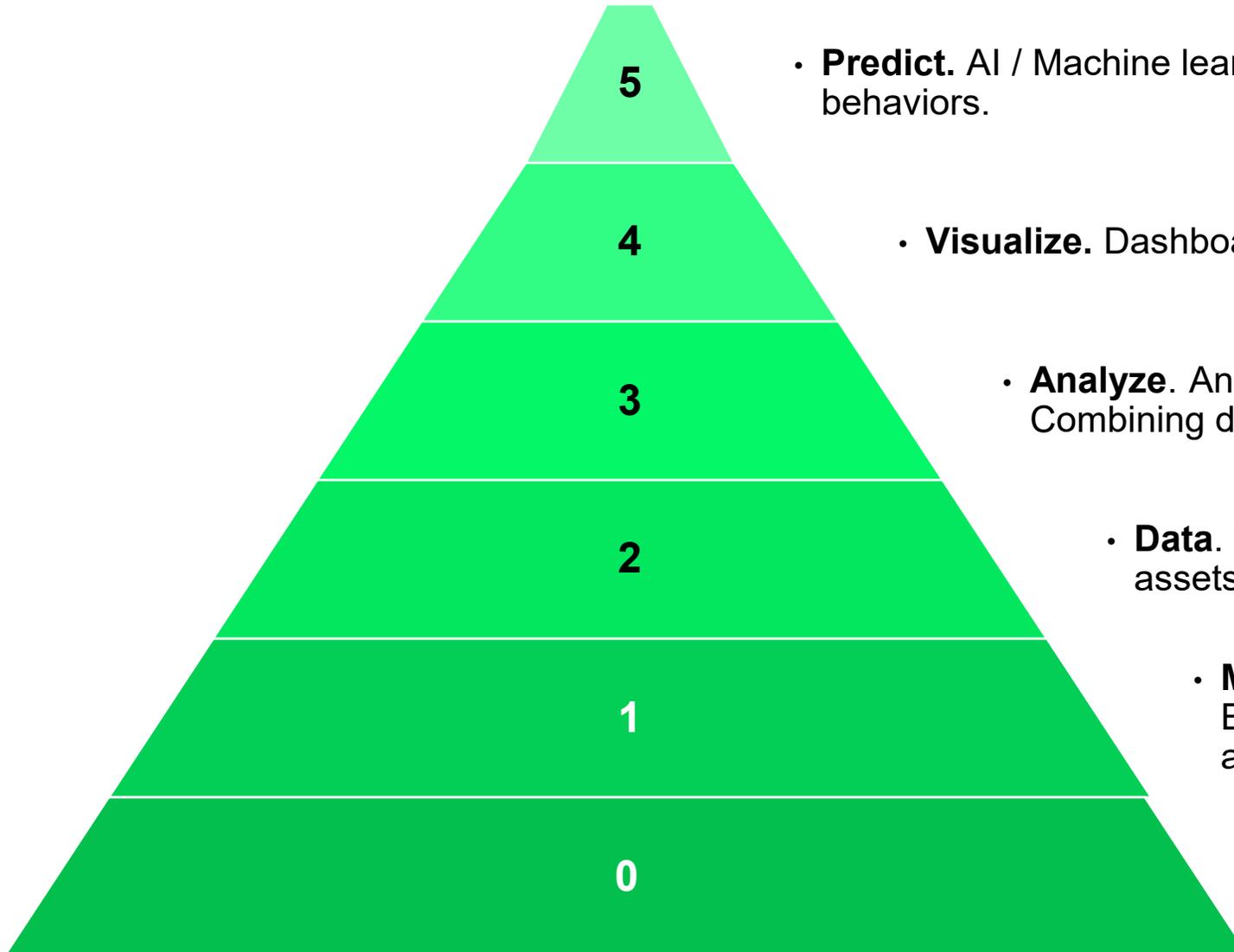
## IoT Devices



## Citizen Science



# Layers of The Digital Twin



- **Predict.** AI / Machine learning to predict performance and behaviors.

- **Visualize.** Dashboards, heat maps, 3D forecasting.

- **Analyze.** Analyzing the data being collected. Combining disparate sources.

- **Data.** What is the data pertaining to the assets that we'll be collecting?

- **Methods.** Transform into GeoDB. Each asset type is an object with attributes.

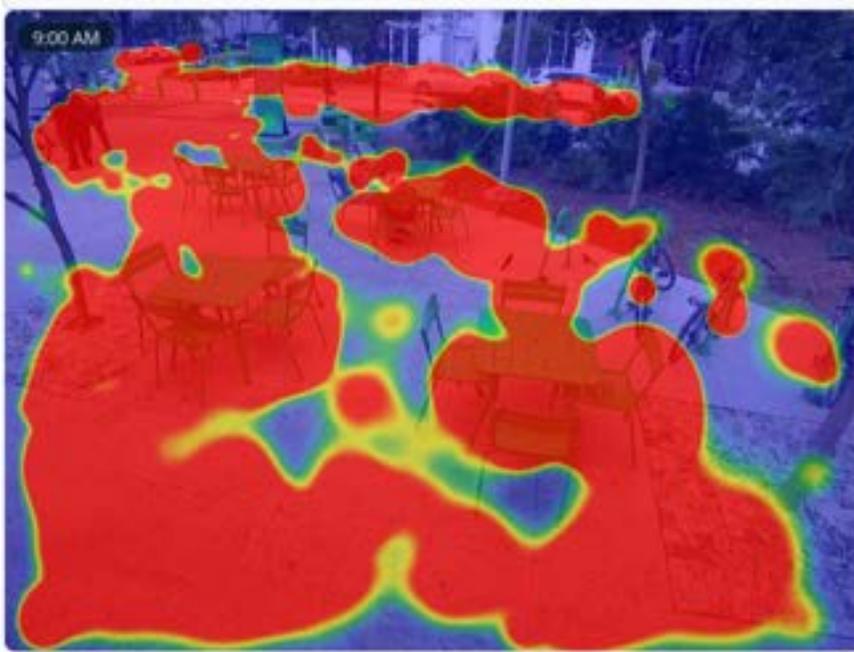
- **Procedures.** What are the assets? Conditions? What needs to be tracked?

# Computer Vision Cameras

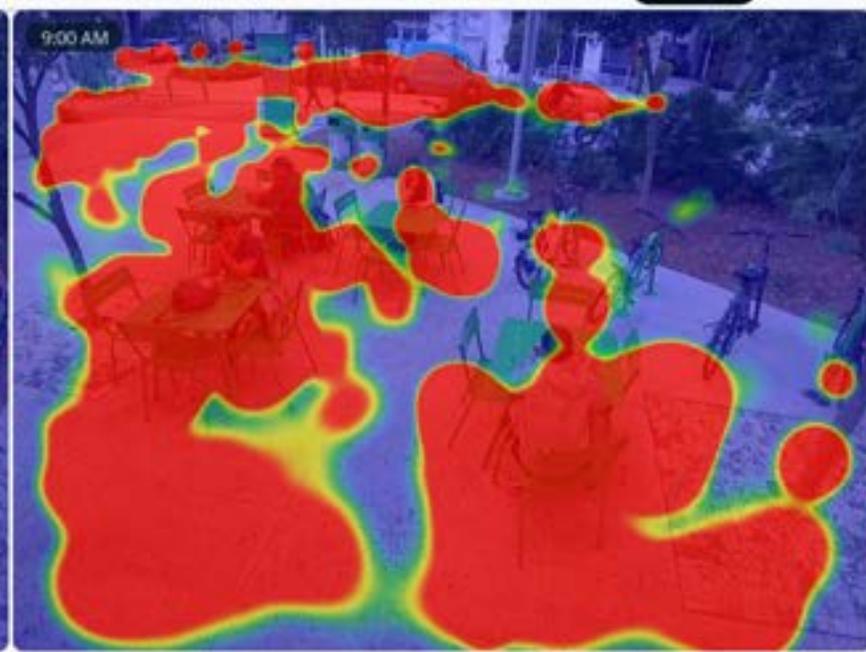
To improve The Underline's safety, planning, and optimization of operational resources.

- comprehensive security camera system.
- Advanced computer vision functionality.
- Increases safety for park visitors
- Improves security monitoring.
- Quickens emergency response.
- Assesses how people interact with our public space.
- Uncovers unique insights and data.
- FDOT Partnership for non-motorized vehicle counts.

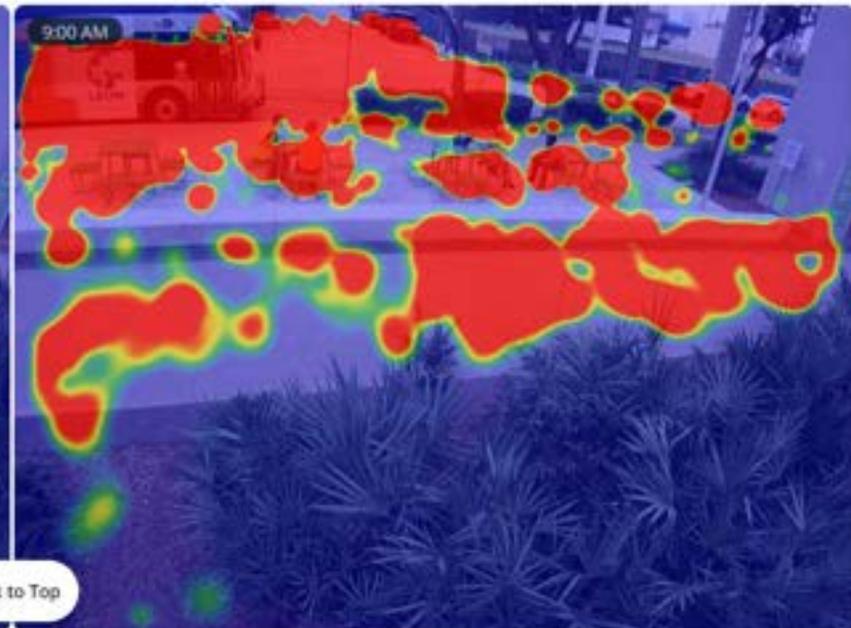
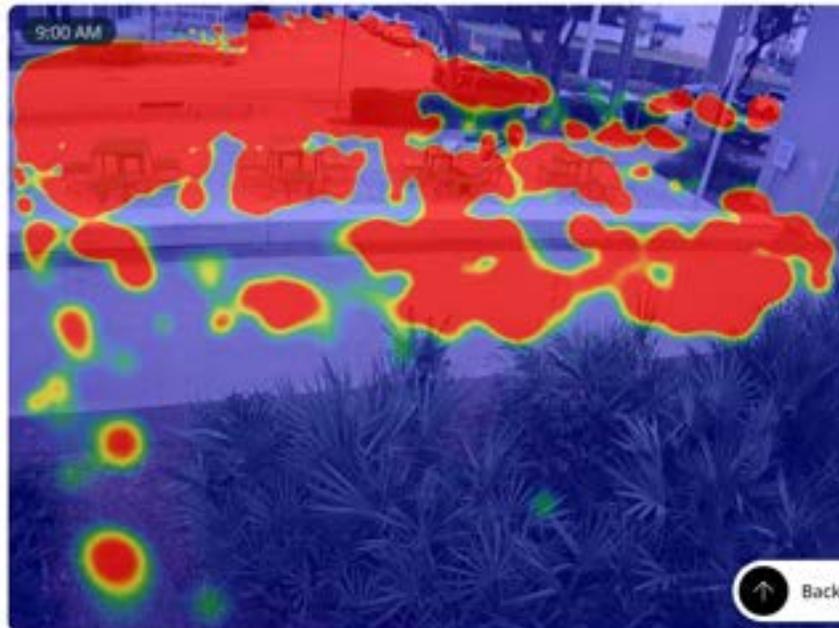




Sunday, January 21, 2024  
Tuesday, January 23, 2024



Saturday, January 20, 2024  
Monday, January 22, 2024



↑ Back to Top

## The Underline **Linear Lab.**

A living lab, testing ground, community engagement hub and deployment sandbox in partnership with Northeastern University, the University of Miami, local private companies, community engagement organizations, and national outreach partners. The Lab's targeted focus on **climate, sustainable mobility, first-mile/last-mile, and energy** will enhance the community's ability to address Miami's largest local issues.



In coordination with county, we can test, iterate and scale these new technologies county-wide.



# On the Horizon

Energy & Microgrids



Interactive Experiences



Startup Accelerator



Linear Lab Deployments



Economic Development



Extended Reality Applications



# Building Capacity

## Tips for developing public space technology

- Master planning
- Strategic partnerships
- Foundations & grants
- Advisory Committee
- Hire technical staff members
- Outsource (dev shops, agencies, developers, experts)
- Invest in dedicated budgets, not just capacity
- Bake technology shifts into your planning
- Be opportunistic



# Thank You

theunderline.org  
@theunderlinemia  
Patrice.gillespiesmith@theunderline.org

<https://www.youtube.com/watch?v=SxEpdZAKs6A&t=5s>

# Digital Guides

Digital companions for place-based experiences and information

- **Soofa.** Solar-powered bulletin boards with real-time transit and event information
- **IKE.** Interactive smart city kiosks with dynamic applications
- **Bloomberg Connects.** Self-guided, interactive tour for visitors to learn about the park.
- **Climate Champs.** Digital curriculum to educate Miami's future environmental stewards.



# Sensors

## Planetwatch Airquino environmental sensors

- Temperature
- Humidity
- Precipitation
- Air Quality Index (AQI)
- Particulate Matter (PM2.5, PM10)
- CO
- NO2
- O3



**TIPS for success  
Staff & resource capacity''**

**Capacity building  
Tech Master Plan  
Tech Council  
CIO  
BUDGET  
Grants  
Partners**

# DTPR Standard

## Place-based community engagement

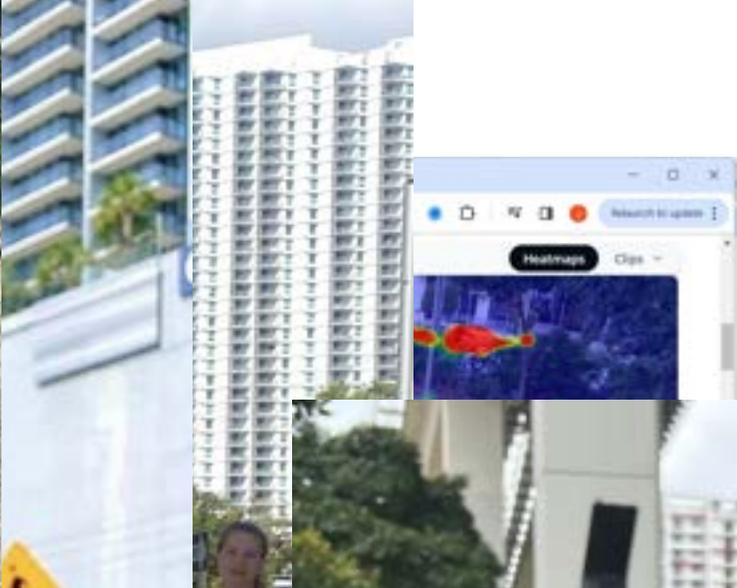
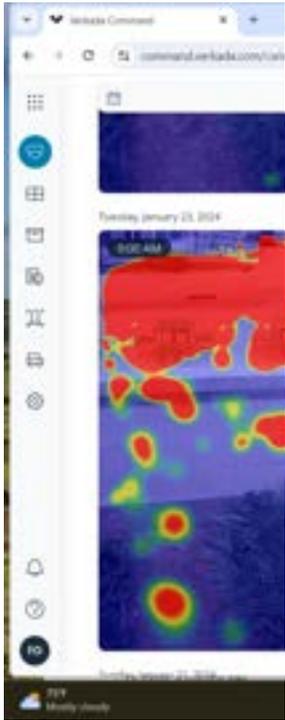
Piloting an open-source communication standard for transparency and accountability around digital technology in public spaces.

- a standard dictionary of concepts around digital tech and data practices
- a standard of icons to communicate those concepts quickly and clearly.
- signage informing our visitors about how we use technology to build trust
- the creation of a user engagement and testing group



**Tips for success**

**Partners**



**What are the two major problems cities should address in the next 10 years?**

**What are the datasets you think are critical to address these challenges?**

**How would you do it?**

# WATERFRONT DATA PROJECT

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Leveraging Big Data For Informed  
Waterfront Access and Inclusivity



# Boston Harbor Now

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Our mission is to ensure that Boston Harbor, its waterfront, and islands are accessible and inclusive to everyone and that these special places are properly adapted to the risks of climate change

Boston Harbor Now is the legislated partner of the **Boston Harbor Islands National and State Park** and the City of Boston's partner for the **Boston Harborwalk**





## Boston Harbor's Transformation Sparked A Need for Equity



- Boston Harbor Cleanup 1990s – early 2000s
- Historical barriers to equitable access
- Growing demand for waterfront access
- Regional economic engine and public health resource

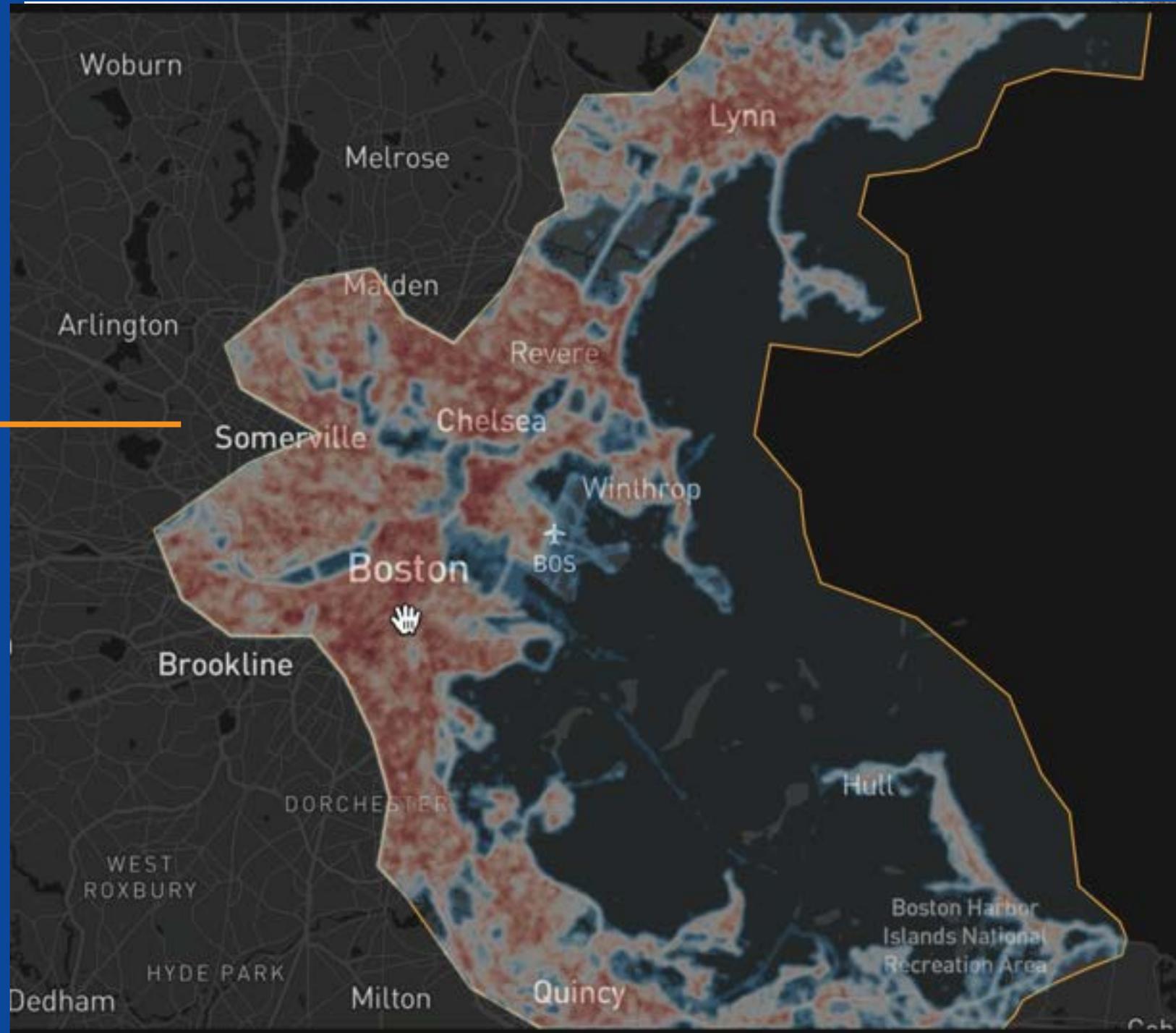
# Public Investments and Unanswered Questions

- Billions in public investment
- Rise of waterfront advocacy
- Desire to measure impact of collective efforts
- Who is benefitting/Who isn't
- Lack of baseline and measurements standards
- Birth of a moonshot



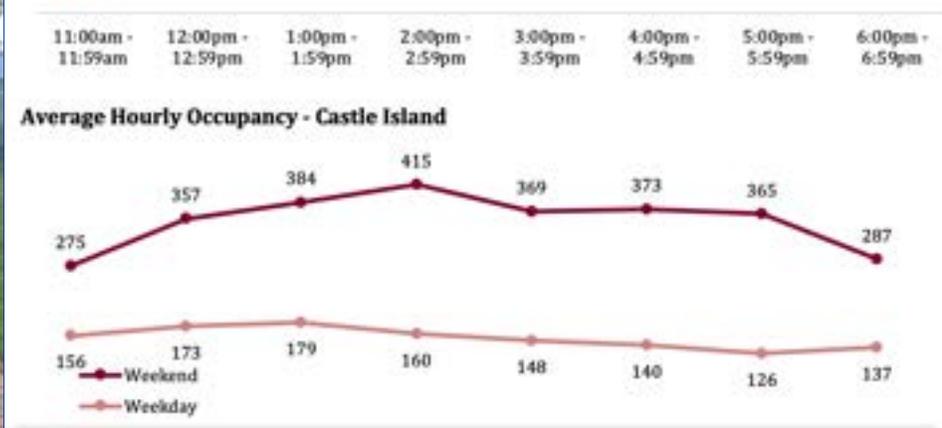
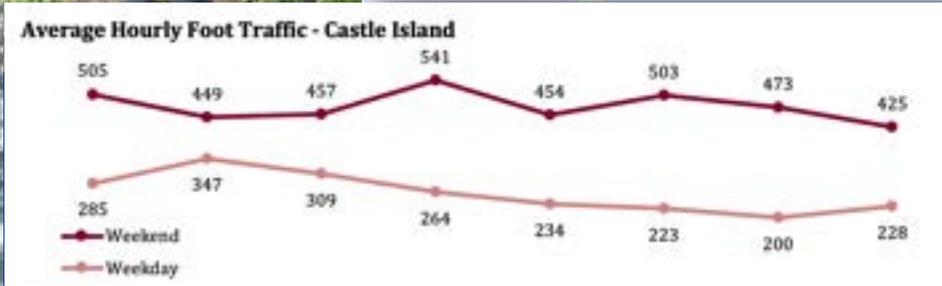
# Blending Tech & Tradition: Equity Study Logistics

- Leveraging “*Location Intelligence*” with super computing, & traditional surveying
- Technology (Tectonix) and data (Veraset) partners
- Privacy considerations
- Additional data enrichments
  - 2020 US Census
  - SafeGraph POI





# Groundtruthing: A sub-study of Five Waterfront Parks



- “Groundtruthing” - To check the accuracy of (remotely sensed data) by means of in-situ observations
- Contracted with MassINC data research firm
- Canvassed and surveyed five Boston waterfront parks
- 10 team members, 800hrs, 8hrs daily, 1555 surveys responses
- Sub-study practice is common in academic and research field

# Building A Collective Baseline: Shaping Boston's Future Through Informed Decision Making

## PROJECT GOALS

### MEASURE

Visitation  
Impact

### DISCOVER

Barriers  
Opportunities

### INFORM

Public Policy  
Programming  
Marketing/Outreach  
Resource Planning  
Future Development



# Funding a Moonshot Project

- Waterfront Data Project was funded by two foundations totaling approx. \$500,000
- Early adoption and customization cost are high
- Out-of-the-box location intelligence platform alternatives:
  - **Tectonix,**
  - **PlacerAI,**
  - **UnaCast**



# Measuring Impact Challenges: Quantifying Belonging



Challenges with measuring  
some program impacts:

- Sampling size issues
- Audience make-up
- Timeframe
- Anecdote vs Data



# Maximizing Staff Capacity Through a Partnership Approach

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**DATA PARTNER**  
Data Provider



**TECHNOLOGY PARTNER**  
Computation



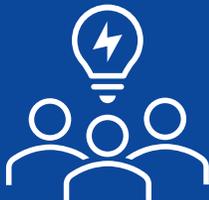
**GROUNDTRUTHING TEAM**  
In-Situ Researchers



**BHN TEAM**  
Project Managers



**PROJECT STEERING COMMITTEE**



**ACADEMIC ADVISOR**



**DATA ANALYST**



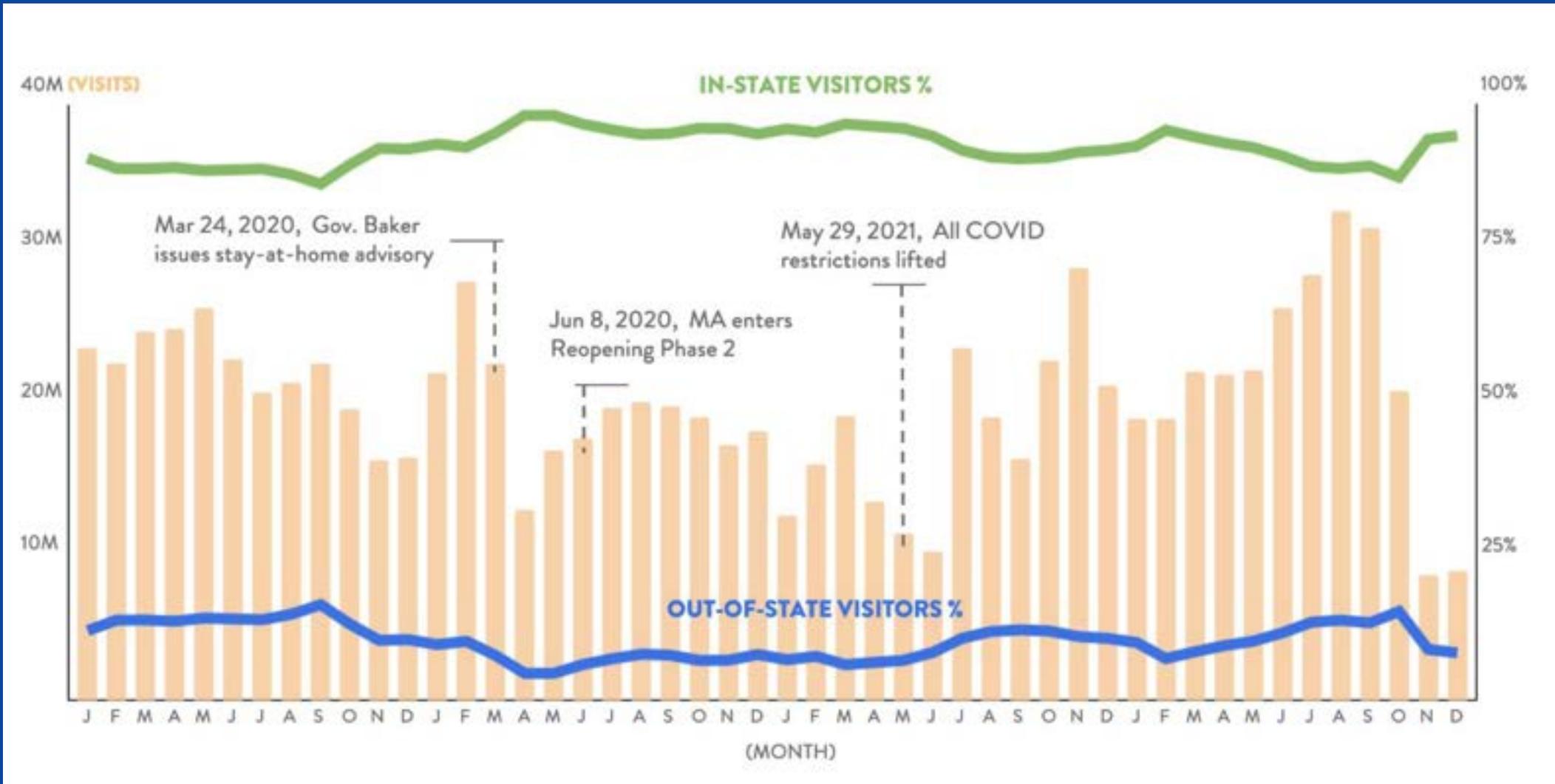
# Insights into Waterfront Visitation: Navigating Post-COVID Trends on Boston Harbor

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- Waterfront visitation hasn't returned to pre-COVID levels, with reduced white visitors' levels significantly impacting recovery.
- Most visitors earn under \$100K annually, indicating a diverse economic background among waterfront users.
- BIPOC communities show notable increases in visits, leading to more equitable representation.
- The Harborwalk and Waterfront parks show different patterns in visitor demographics, with BIPOC representation being higher in parks.

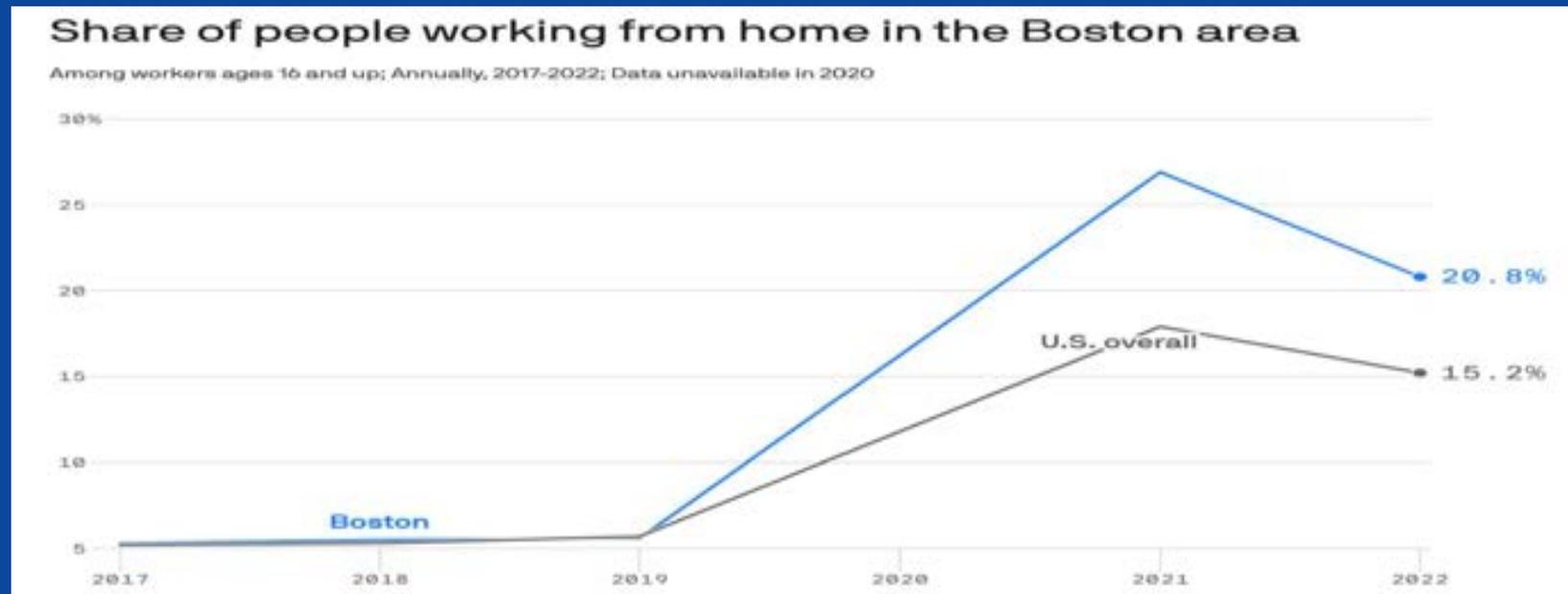
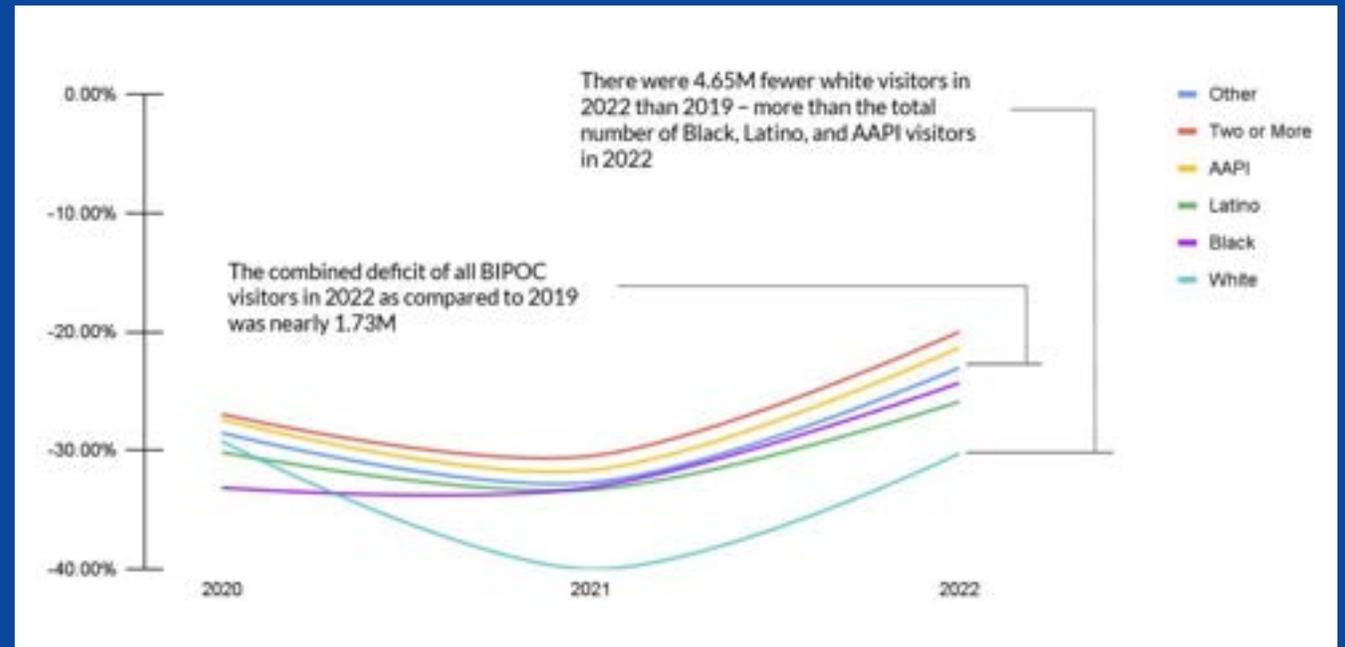
# Total Monthly Visits to Boston's Waterfront By Non-Residents (2019 – 2022)

Tourism numbers post-pandemic continues to rebound with in-state visitors making up the bulk of all visits.



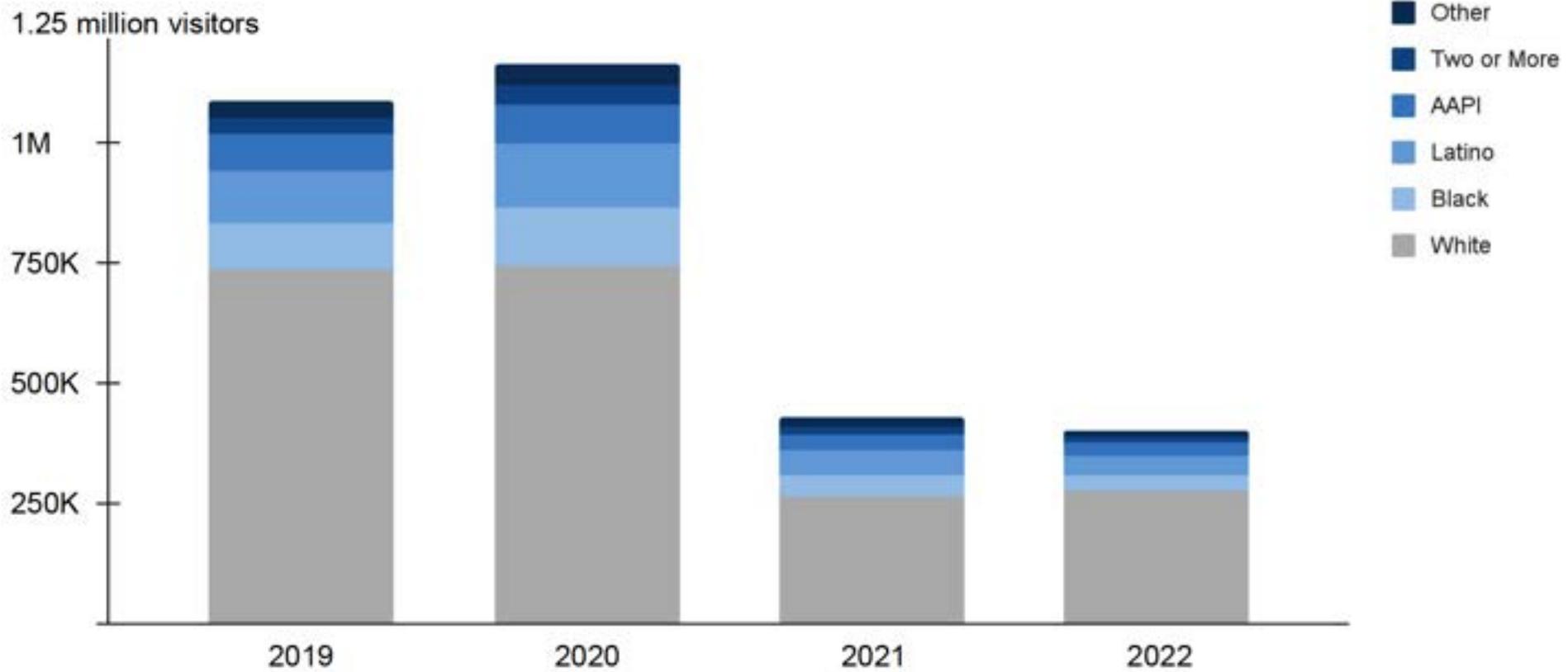
# Decreases in Waterfront Visitation since 2019

Return of White visitors trail behind other groups in returning to the waterfront impacting recovery.



# Total Waterfront Park Visitation (2019 - 2022)

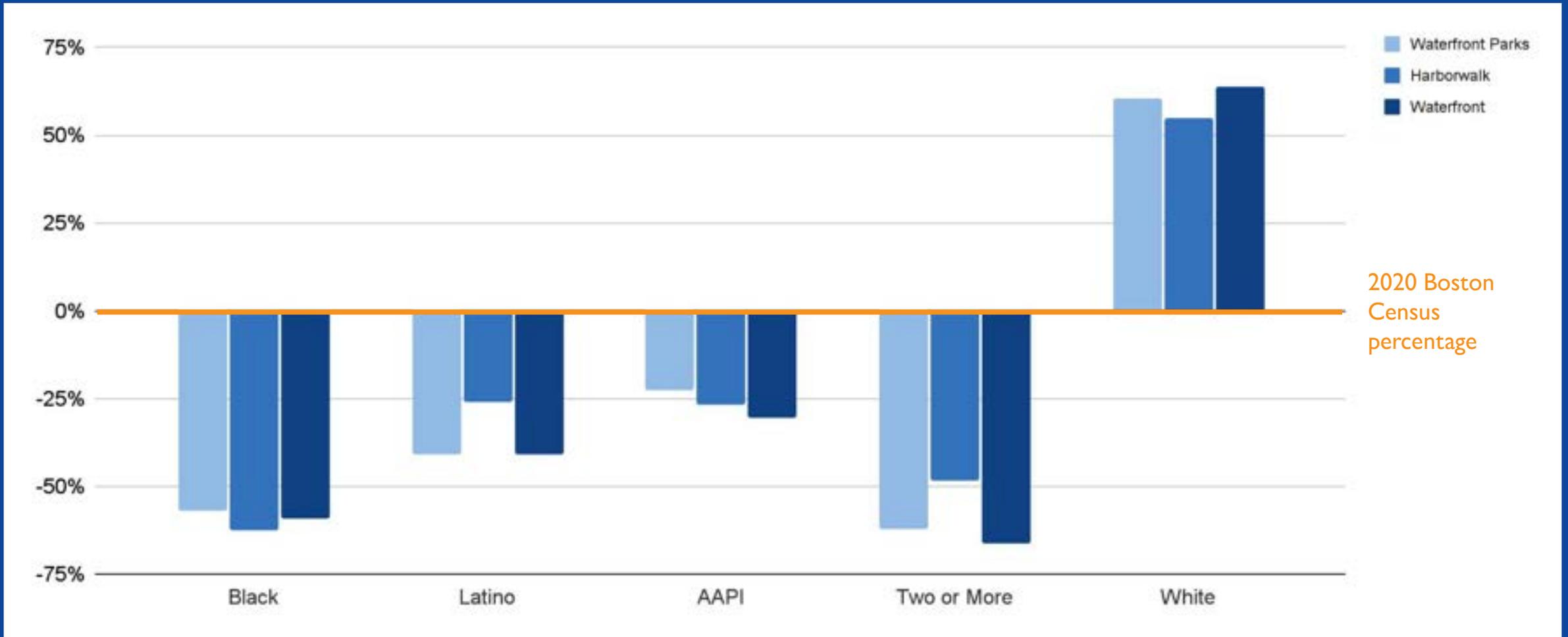
Waterfront Parks saw an increase in usage during the COVID pandemic “anthropause” by all groups but significantly from BIPOC visitors.

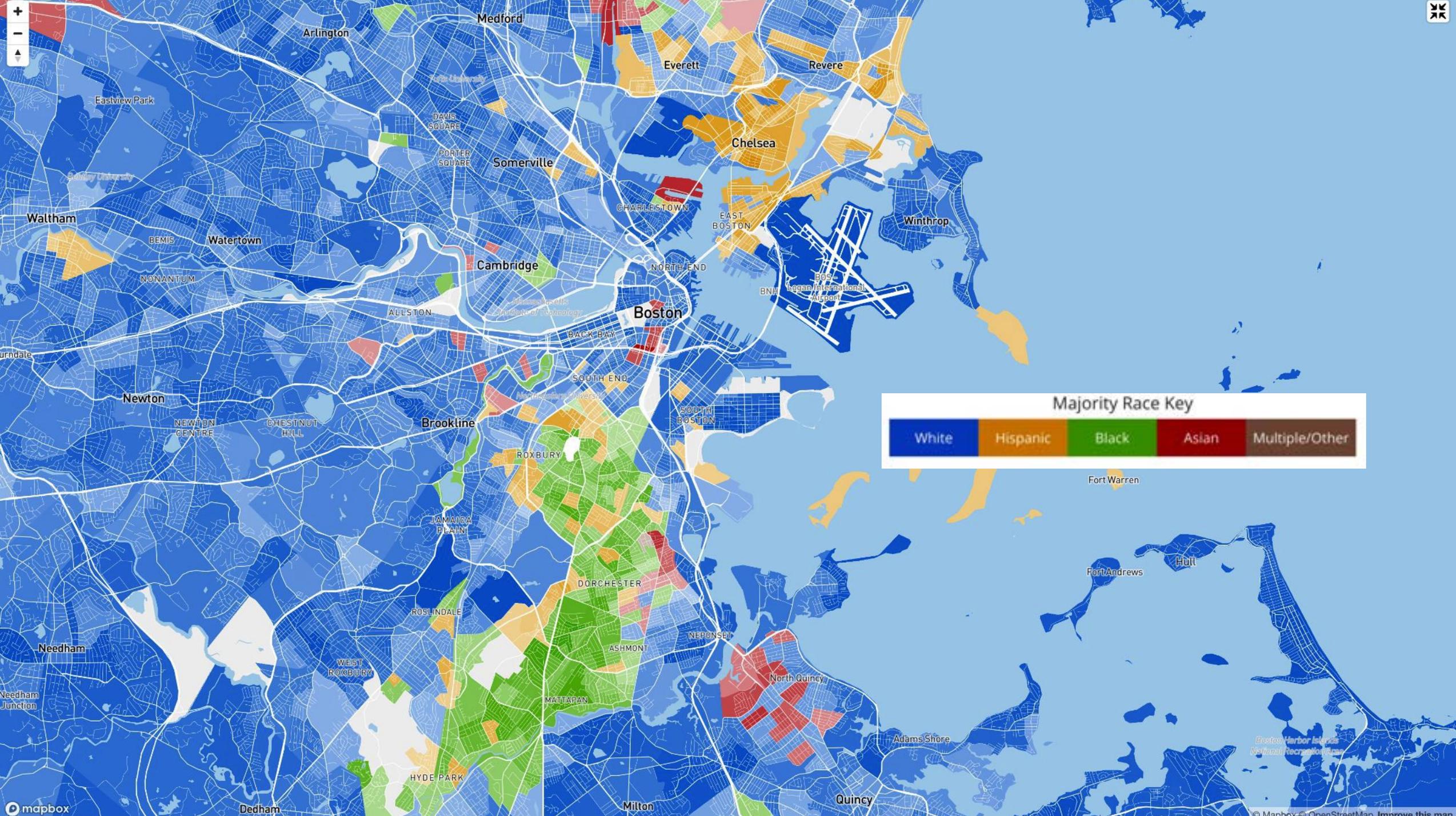


Source: Veraset

# Equitable Representation In Waterfront Parks vs Harborwalk and Waterfront

Representation of some BIPOC communities more closely mirrors the demographics of the city at waterfront parks than on the Harborwalk and broader waterfront.





Majority Race Key

White	Hispanic	Black	Asian	Multiple/Other
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# Next Steps & Applications

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- Project final report / whitepaper
- Project landing page with open-source data
- GitHub code repository
- Stakeholder resources to identify and address accessibility issues
- Extreme weather & baseline usage shift studies
- Webinars and Conferences



A photograph of two children wearing bicycle helmets, one in a red and black helmet and the other in a yellow and black helmet. They are standing on a waterfront promenade with a metal railing, looking through a large telescope. The background shows a city skyline across a body of water under a clear sky.

# Pro Tips & Lessons Learned

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- Staffing Capacity Considerations
- Data Science Resources
- Clear Goals and Hypothesis
- Be Aware of Biases/Data Limitations
- Contingencies



# Acknowledgements

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## Team

BHN colleagues

Data analyst

## Partners

Tectonix & Veraset

Dr. Nishant Kishore

Project Steering Committee members

Public agencies: City of Boston, MassDCR, National Park Service

## Funders

Anonymous foundation

The Barr Foundation

A couple is sitting on a grassy hill, looking out over a harbor. The woman is wearing a white tank top and a white hat, and the man is wearing an orange shirt. They are sitting on a pink blanket. There are several trees in the foreground and background, and a sunset is visible in the sky. The harbor has several boats and a city skyline in the distance.

# Thank you!

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Christian Merfeld  
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*Thanks for joining us!*

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**Registration opens Feb 12!**



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**PARKS**  
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